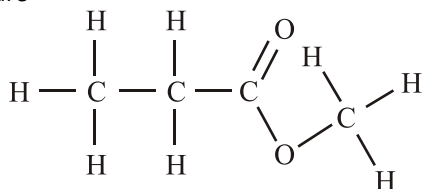


## TAD04 – A5 IB Practice MS

1. (a) bond angles change/bonds bend;  
bond lengths change/bonds stretch;  
*If neither scored, allow [1] for bonds vibrate.*  
bond polarity changes; 3
- (b) W: C—O, C=O, O—H;  
X: C—O, O—H;  
Y: C—O, C=O; 3
- (c) (i) two different chemical environments for hydrogens/two different  
'types' of proton/OWTTE; 1  
(ii) CH<sub>3</sub> and CH next to each other/CH<sub>3</sub>CH<sub>2</sub>/ethyl group; 1
- (d) W: CH<sub>3</sub>COOH  
X: CH<sub>3</sub>CH<sub>2</sub>OH;  
*Accept C<sub>2</sub>H<sub>5</sub>OH.*  
Y: CH<sub>3</sub>COOCH<sub>2</sub>CH<sub>3</sub>; 3  
*Accept CH<sub>3</sub>COOC<sub>2</sub>H<sub>5</sub>.*  
*If displayed formulas attempted, penalize missing H atoms once only.*
- (e) (i) 3000 – 2900 (cm<sup>-1</sup>) C—H;  
1750 – 1700 (cm<sup>-1</sup>) C=O;  
1150 – 1200 (cm<sup>-1</sup>) C—O; 3  
*Above can be in any order as long as bond linked with correct wave number.*  
(ii) CH<sub>3</sub>CH<sub>2</sub>COOCH<sub>3</sub>; 1  
*Accept C<sub>2</sub>H<sub>5</sub>COOCH<sub>3</sub> and HCOOCH(CH<sub>3</sub>)<sub>2</sub> and CH<sub>3</sub>COCH<sub>2</sub>OCH<sub>3</sub>.*  
*If displayed formula attempted, penalize missing H atoms unless already penalized in (d).*

[15]

2. (a) (i) the number of different hydrogen/proton environments/OWTTE; 1  
(ii) the environment of proton/neighbouring group/OWTTE; 1  
(iii) the ratio of the numbers of protons in each environment; 1  
(iv) the number of (identical) protons on the neighbouring carbon atom(s); 1
- (b) 0.9 ppm H on C attached to a second C/alkyl group/R—CH<sub>3</sub>  
2.0 ppm H on C attached to carboxyl C/C of an ester/CH<sub>3</sub>—CO—OR  
4.1 ppm H on C attached to O of carboxyl group/ester group/  
R—CO—OCH<sub>2</sub>R 3
- (c) Structure 2

**Explanation [3 max]**two CH<sub>3</sub> groups in different environments;one CH<sub>3</sub> group is not next to a C/has no neighbouring protons;

because it is a singlet (at 4.1ppm);

CH<sub>2</sub> next to CH<sub>3</sub>/C<sub>2</sub>H<sub>5</sub>;

because of triplet and quartet;

5 max

*Award [2] for correct structure, [3] for any three correct points for explanation.**Award [3 max] if structure CH<sub>3</sub>COOCH<sub>2</sub>CH<sub>3</sub>.*

[12]

